PLANNING AND REVIEW OF ACCELERATOR FACILITIES AND THEIR OPERATIONS

INTRODUCTION

This chapter describes the formal review procedures established by the Laboratory to assure that accelerator facilities and their operations comply with Fermilab ES&H standards. This review system shall be applied to new projects or when significant modifications, including decommissioning, occur. The depth of detail required in the Safety Assessment Documents (PSAD/SAD) and the amount of resources expended in the accelerator readiness review and its accompanying documentation should be commensurate with the programmatic importance and potential ES&H impact of the facility and its activities. The Fermilab Environmental, Safety and Health Manual (FESHM), inclusive of the Fermilab Radiological Control Manual (FRCM), specifies a set of physical and administrative conditions that define the bounding conditions for safe operation of accelerator facilities or portions thereof.

In addition to the Safety Assessment Documents (SADs), the ES&H Section conducts other types of reviews of new projects to assure that environment, safety, and health requirements are met. Chapter 8060 describes, in detail, the Laboratory's program for reviewing its activities under the National Environmental Policy Act (NEPA). Likewise, planning for future decontamination and decommissioning (D&D) activities should be developed as specified in Chapter 1070.

The Director, as advised by the Senior Laboratory Safety Officer (SLSO), determines the PSAD/SAD applicability, notifies the responsible division/section and gives guidance on the level of details required. Divisions and Sections are responsible for maintaining their SADs and associated Accelerator Safety Envelopes (ASEs) up-to-date by revising them when necessary. Revised SADs and ASEs shall be reviewed and approved in accordance with the procedures of this chapter. SADs commonly incorporate the results of a separate Shielding Assessment prepared, reviewed, and approved in accordance with Fermilab Radiological Control Manual (FRCM) Chapter 8.

DEFINITIONS

1. Accelerator: A device employing electrostatic or electromagnetic fields to impart energy to molecular, atomic or sub-atomic particles and, for the purposes of this Standard, capable of creating a radiological area as defined by 10 CFR 835.

2. Accelerator Facility: The accelerator and associated plant and equipment utilizing, or supporting the production of, accelerated particle beams to which access is controlled to protect the safety and health of persons. It includes experimental enclosures and experimental apparatus utilizing the accelerator, regardless of where that apparatus may have been designed, fabricated, or constructed.

3. Accelerator Safety Envelope: A set of physical and administrative conditions that defines the accelerator / storage ring beam bounding conditions for safe operations.

4. Hazard Analysis: A documented process:
   - to systematically identify the hazards of a given operation;
   - to describe and analyze the adequacy of measures taken to mitigate the hazards of normal operation; and,
   - to identify and analyze potential accidents and their associated risks.

5. Preliminary Safety Assessment Document (PSAD) (see SAD definition): A preliminary formal review document to analyze Laboratory projects, operations and experiments for possible hazards (see Work Smart Standards list, Chapter 1070) and possible ways to mitigate them. For a major project, Fermilab may choose to prepare a PSAD to support deliberations leading to *approval to initiate construction*.

6. Accelerator Readiness Review (ARR): A review that is to determine if all necessary devices and procedures are in place to ensure safe operation of an accelerator or facility. Upon satisfactory completion of the review and close-out of significant issues, *approval to operate* is signified by signatures on the PSAD / SAD / ARR Documentation form attached to this chapter.

7. Safety Assessment Document (SAD): A formal review document describing the analysis of Fermilab projects, operations and experiments for hazards and their final method of mitigation. A SAD does not have to be written for unmodified commercially available units such as electron microscopes, ion implantation devices and x-ray generators which are acceptable industrial applications.

PSAD/SAD PROCESS DESCRIPTION

The Accelerator PSAD / SAD and the associated ARR process is initiated with either a recommendation by the Senior Laboratory Safety Officer (SLSO) to the Director concerning the applicability of PSAD / SAD for a proposed project, operation or

experiment or a similar determination by the division/section head(s) responsible for the activity.

Following this determination of applicability, the responsible division/section will prepare a PSAD, the approval of which allows initiation of more detailed design and/or construction. In some instances, multiple divisions/sections may be involved. A SAD may be prepared concurrently with the PSAD or, more commonly, it may be prepared at some later time prior to operations when detailed hazard analyses and mitigation methodologies are available. For projects of limited scope, the PSAD step may be determined to not be required.

A completed PSAD or SAD shall be submitted to the ES&H Section for review. For new facilities or for those that have been significantly modified, this would initiate a documented ARR conducted by the ES&H Section. The ARR may conclude with a list of items that need to be completed (punch list) before the approval to operate is granted. Upon successful completion of the review by the ES&H Section and close-out of all significant issues, the SLSO then recommends approval of the final SAD/Accelerator Readiness Review to the Director.

Experience has indicated that this process is greatly enhanced by timely, effective collaboration and communication between the responsible division/section and the ES&H Section. Involvement of representatives of the DOE Fermi Site Manager at an early stage of project planning has also been found to be highly beneficial.

Each one of the above steps is described in detail below. These steps should be followed in sequential order.

1. Determination of Applicability

   The SLSO regularly reviews projects, operations, and experiments for applicability of the provisions of this chapter and makes corresponding recommendations to the Director concerning SAD/PSAD applicability. Also, Division/Section Heads shall inform the SLSO of new projects, operations, and experiments that are candidates for SADs at the earliest reasonable stage. Fermilab authorized operations that require a project directive or that originate outside the Laboratory may also require a PSAD/SAD. Following the determination of applicability, the ES&H Section notifies the responsible division/section of the PSAD/SAD applicability. This formal notification is not needed if the responsible division/section has already determined that a SAD is to be revised or prepared. This determination and subsequent PSAD/SAD initiation must occur during the earliest phases of the activity to facilitate early hazard identification and mitigation. The documentation for the determination

of applicability shall be inventoried and filed with the ES&H Section regardless of the conclusion.

A new PSAD/SAD is not required for upgrades to an existing facility or operation that are within the scope of its existing SAD. Documentation demonstrating that the upgrade is within the scope of the existing SAD shall be written by the responsible division/section and be filed with the ES&H Section.

2. PSAD Hazard Analysis

The PSAD should follow the guidelines outlined in Chapter 2010TA. In general, the hazard analysis in the PSAD should start with the Work Smart Standards list (Chapter 1070). These standards are the result of Fermilab's analyses of the hazards present on the Fermilab site and identify the statutory requirements, and external and internal standards to be followed in order to mitigate these hazards. These standards are identified in the Fermilab Work Smart Standards (WSS) as part of the contract with the Department of Energy.

For the most part, the hazards associated with a project which does not pose any additional hazard by virtue of their association with the project's construction, commissioning, or operation are addressed by implementing the provisions of other FESHM chapters. For such hazards, it can simply be stated that the WSS will be followed just as they would for other operations on site.

It is possible that for some projects there are some hazards which are unique to that project. Those unique hazards have to be identified and possible ways to mitigate them should be described.

3. SAD Hazard Analysis

The SAD should follow the same guidelines as those given for PSAD, except when describing the mitigation of the unique hazards, the final method implemented by the project should be described. In general the conclusions of the SAD will support the parameters of the associated Accelerator Safety Envelope (ASE). Commonly, the ASE constitutes a chapter or a portion of a chapter of the SAD.

4. Review of PSAD/SAD

The divisions/sections may review new projects or facilities. This review may be done through a safety review panel. The safety panel may consist of laboratory staff or experts from outside the Laboratory. The responsible division/section may request assistance from the Laboratory Safety Committee

and its Subcommittees to review projects, answer specific safety questions, recommend solutions to ES&H problems, assist in setting ES&H policy, or evaluate requests for exemptions from existing policies. The reviewers assigned by the SLSO to review the PSAD/SAD shall be selected with due consideration given to maintaining a reasonable level of independence from the activity being assessed while optimizing the utilization of subject matter experts. The reviewers will commonly, but not exclusively, be members of the ES&H Section staff. For SADs/Accelerator Readiness Reviews concerned with strategic or major system projects (as defined by DOE) or line item projects, one or more representatives of the DOE-Fermi Site Manager may be included as observers on the assigned review team preparatory to the official transmittal for concurrence specified below. The list of reviewers of each SAD shall be documented along with any comments they may develop.

5. PSAD/SAD and ARR Approval

a. It is the responsibility of the SLSO to determine if the PSAD/SAD/ and ARR approval chain shall include the Fermilab Associate Director for Operations Support, and the Fermilab Director. The SLSO also determines if a copy should be transmitted to the DOE -Fermi Site Manager for concurrence based upon the scope of and level of hazards presented by the activity. All SADs resulting in a new or revised Accelerator Safety Envelope (ASE) require written concurrence with the SAD and written approval of the ASE by the DOE-Fermi Site Manager. Informational transmittals are required for strategic or major system projects (as defined by DOE) and for line item projects. Normally, PSADs are not transmitted to the DOE-Fermi Site Manager.

The final sign-off sheet to be used for PSAD/SAD and ARR approval appears as the last page of the Technical Appendix (2010TA). PSAD/SAD and ARR approval and approval to commence commissioning/operation requires the following signatures which shall be routed in the following order:

1. Project Leader

2. Fermilab Division/Section Head(s)

3. Fermilab Senior Laboratory Safety Officer

4. Fermilab Associate Director for Operations Support (if appropriate)

5. Fermilab Director (if appropriate)

b. If determined appropriate (see Section 5a) by the Fermilab Senior Laboratory Safety Officer, a copy of the PSAD/SAD, along with any new or revised ASE, and documentation of the ARR process shall be sent to the DOE-Fermi Site Manager for concurrence and approval of the ASE before commissioning or operations ensue. This formal transmittal should occur after completion of the internal review process documented by the above signatures. If no comments or replies are received within 30 calendar days, it will be assumed that the PSAD/SAD or ARR is sufficient. This comment period will be 15 calendar days provided a complete draft SAD, that has undergone preliminary review by the ES&H Section, is informally provided to the DOE-Fermi Site Manager at least 30 calendar days prior to the formal submittal of the completed SAD. For projects determined sufficiently significant to have the corresponding SAD sent to the DOE-Fermi Site Manager, the DOE -Fermi Site Manager will be informed of the readiness review before its occurrence and be given the opportunity to participate informally in the review. Experience has shown that early involvement of representatives of the DOE-Fermi Site Manager can enhance the effectiveness of this review process.

6. Documentation

The completed, original PSAD/SAD and specific supporting documentation related to the review shall be inventoried and filed with the ES&H Section in a manner consistent with records retention requirements.

PSAD/SAD GUIDELINES

The PSAD/SAD documents may contain references to other PSADs/SADs, procedures and documents as appropriate rather than repeating large portions of an existing document.

Where commissioning is to be accomplished in discrete modules, the SAD and/or the ARR may be conducted incrementally also. Each module shall require separate authorization.

The PSAD/SAD should be written in accord with the following outline, as applicable:

I. Introduction/Project Description

Provides a brief description of the project:

- Location
- Purpose of Project
- Organizational Responsibilities
- Safety Design Criteria (i.e., the Fermilab Standards)

II. Inventory of Hazards and Mitigation

The PSAD/SAD may present the hazards and discuss their mitigation in a chronological order, i.e. hazards associated with the construction phase, operations, and finally D&D.

Hazard mitigation often includes:

- Shielding analysis
- Engineering design
- Operational constraints
- Training requirements
- Procedural requirements
- Applicable administrative controls
- Accelerator Safety Envelope

  The safety envelope may contain or reference other sections of the SAD that address the following issues as requirements for operation:

  * Power limits (particles, energy, duty factor, or equivalents)
  * Personnel specifications (e.g. operator training)
  * Environmental limits (e.g. potential air emissions, contamination of the groundwater)

* Safety systems which must be operational (e.g. radiation safety interlocks, electrical interlocks, fire protection, etc.)

III. Accelerator Readiness for Commissioning and Operation

Defines the required readiness elements, including those identified in the SAD that are required to be in place during the commissioning and operation stages to ensure safe operation. Requirements from other documents should be included, as appropriate, for completeness. The elements that should be described are:

- Readiness of safety systems
- Qualification of personnel
- Shielding readiness and / or administrative procedures required
- Plan for commissioning / operation
- Environmental monitoring considerations.

IV. Conclusion

At this point it should be possible to briefly conclude that the construction, operation and the final D&D may be conducted in manner acceptable by safety and environmental standards.

SAFETY ASSESSMENT DOCUMENT
ACCELERATOR READINESS REVIEW
DOCUMENTATION FORM

This form records the PSAD/SAD/ARR review process required for operations at Fermi National Accelerator Laboratory.

PSAD/SAD/ARR TITLE AND DATE: _____

_____

_____

THIS DOCUMENT DESCRIBES:

New Facility	_____	New Experiment	_____
Existing Facility	_____	Major Modification	_____
Entire Program	_____	Decommissioning	_____
Readiness Review	_____		

FERMI NATIONAL ACCELERATOR LABORATORY

Safety **Assessment** Document Approval _____ Completion of Readiness Review _____

Authorization to Operate Facility _____

Project Leader/Date: _____

Fermilab Division/Section Head(s)/Date: _____

_____

Fermilab Senior Laboratory Safety Officer/Date: _____

Fermilab Associate Director for Operations Support/Date: _____

(if appropriate)

Fermilab Director/Date: _____

(if appropriate)

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